Traffic Engineering and Safety Systems Branch

2006 Traffic Engineering Conference

LED Traffic Signals
A Life Cycle Analysis

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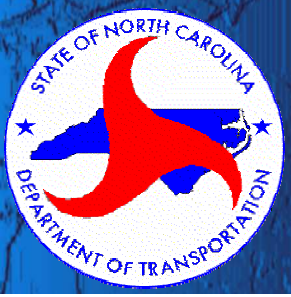


Background:

- NCDOT's experimental use of red ball and arrow indications began in 1992
- Testing revealed a high rate of light output degradation with the AlInGaAs semiconductor materials
- Industry developed AlInGaP semiconductor material with improved degradation characteristics

Background: (cont.)

- In 1999, NCDOT began state-wide use of red LED ball and arrow indications on new projects
- In late 2000, NCDOT began using green LED ball and arrow indications
- In September 2001, NCDOT's policy was revised to require the use of R, Y, and G LED indications for all new installations

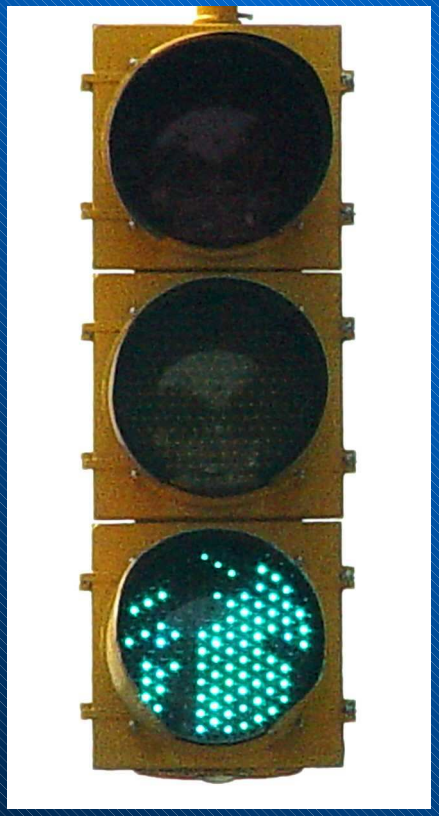
Background: (cont.)

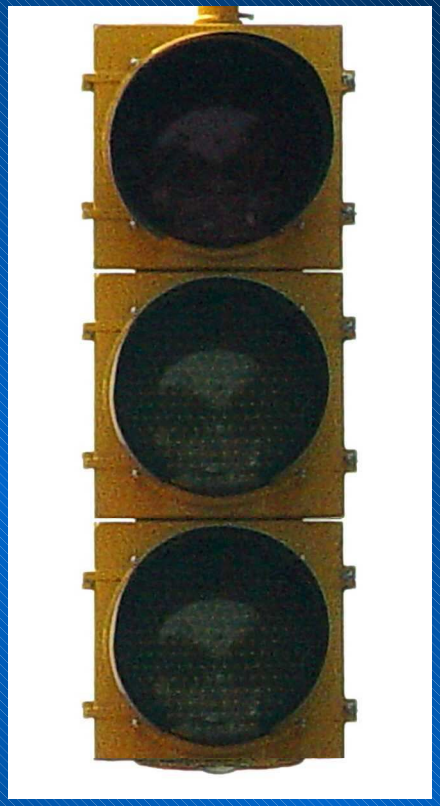
- Experimentation with K-Light hand-held light meter was abandoned because:
  - Single point reading could not be correlated to specification requirements
  - Acceptable readings were dependent on LED modules' design (# of LED's, LED spacing, lense design)

LED Signal Module Failures

- Hard failure of an electronic component
- Degradation of light output over time

Hard failure of an electronic component





Degradation of light output over time

Factors affecting rate of degradation

- LED semiconductor materials
- LED encapsulating materials
- Duty cycle
- Operating current
- Regulation of power supply

Initial Testing Plan

- Total of 20 samples
  - Variety of displays
    - Red, yellow, and green
    - Balls and arrows
  - Variety of manufacturers/models
  - Installed across the State

Initial Testing Plan

- Total of 20 samples
  - 5 red balls
  - 5 yellow balls
  - 5 green balls
  - 5 red arrows

Initial Testing Plan

- Three vendors
  - Dialight
  - Leotek
  - Cooper

Initial Testing Plan

- Total of 20 samples
  - 4 samples from Div. 2
  - 4 samples from Div. 4
  - 8 samples from Div. 10
  - 4 samples from Div. 13

Test Results

- 11 out of 20 samples with 3 data points
  - (2) red ball, (2) yellow ball,
    (4) green ball, (3) red arrow
  - Two vendors

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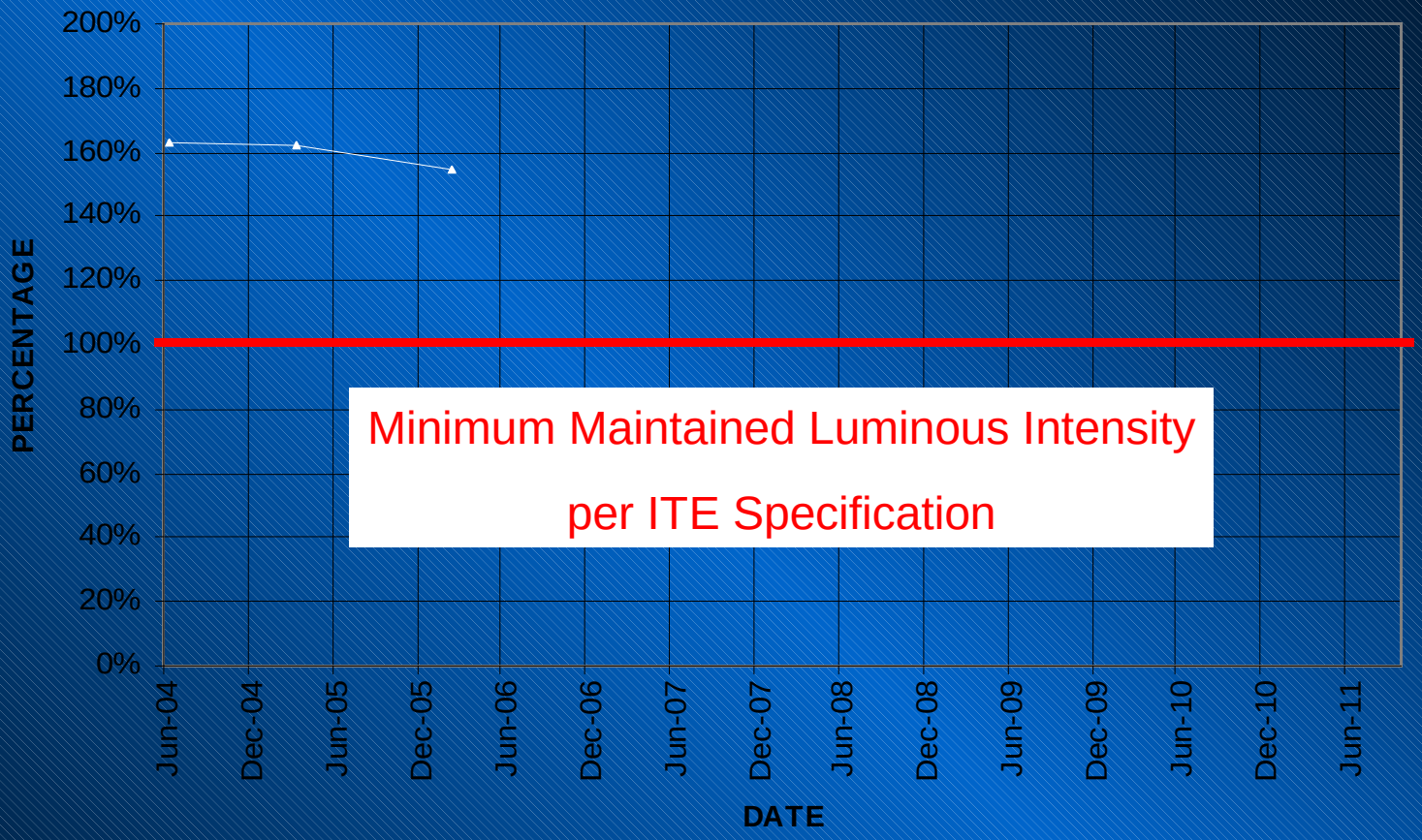

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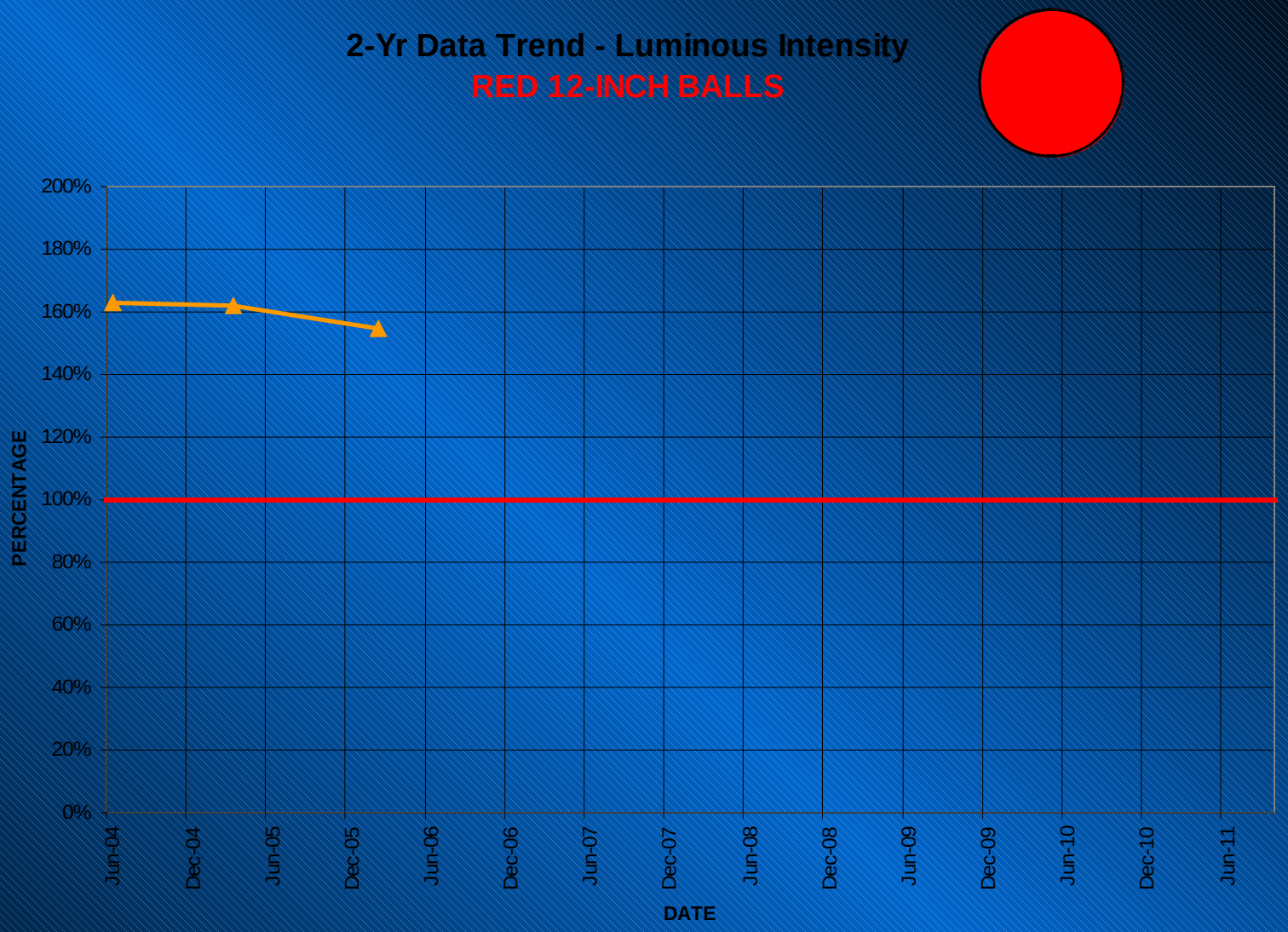

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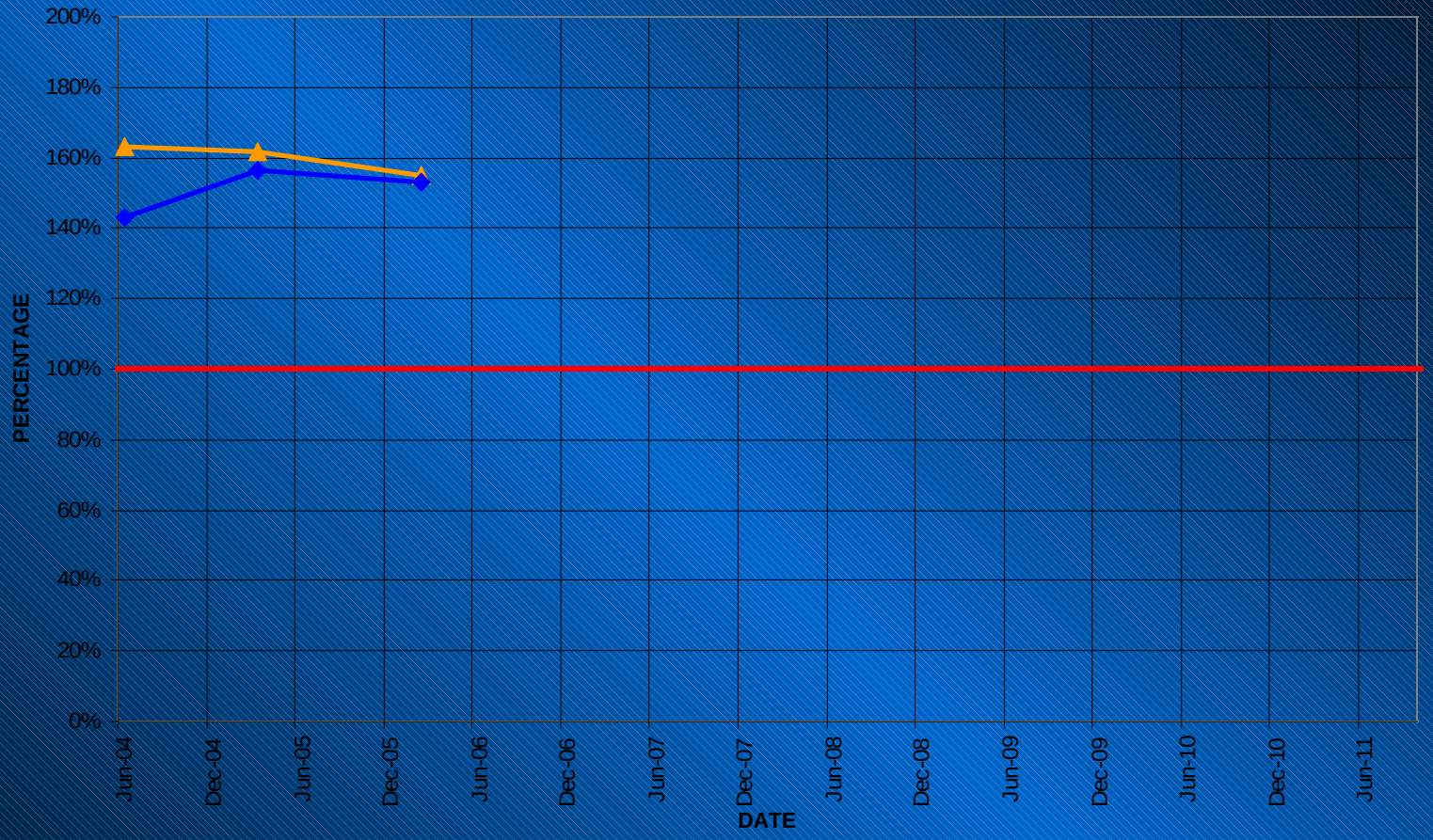
2-Yr Data Trend - Luminous Intensity
RED 12-INCH BALLS



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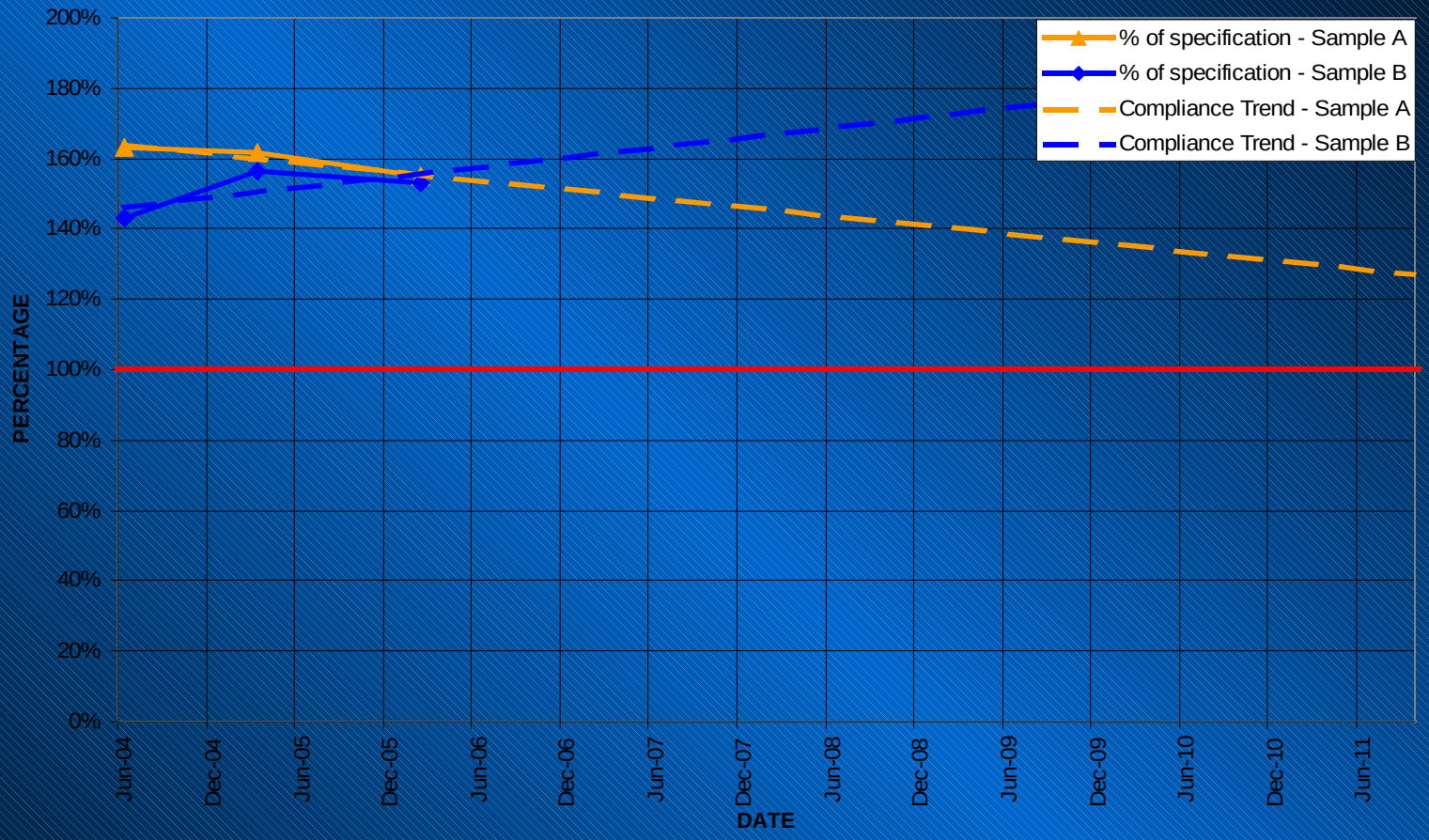

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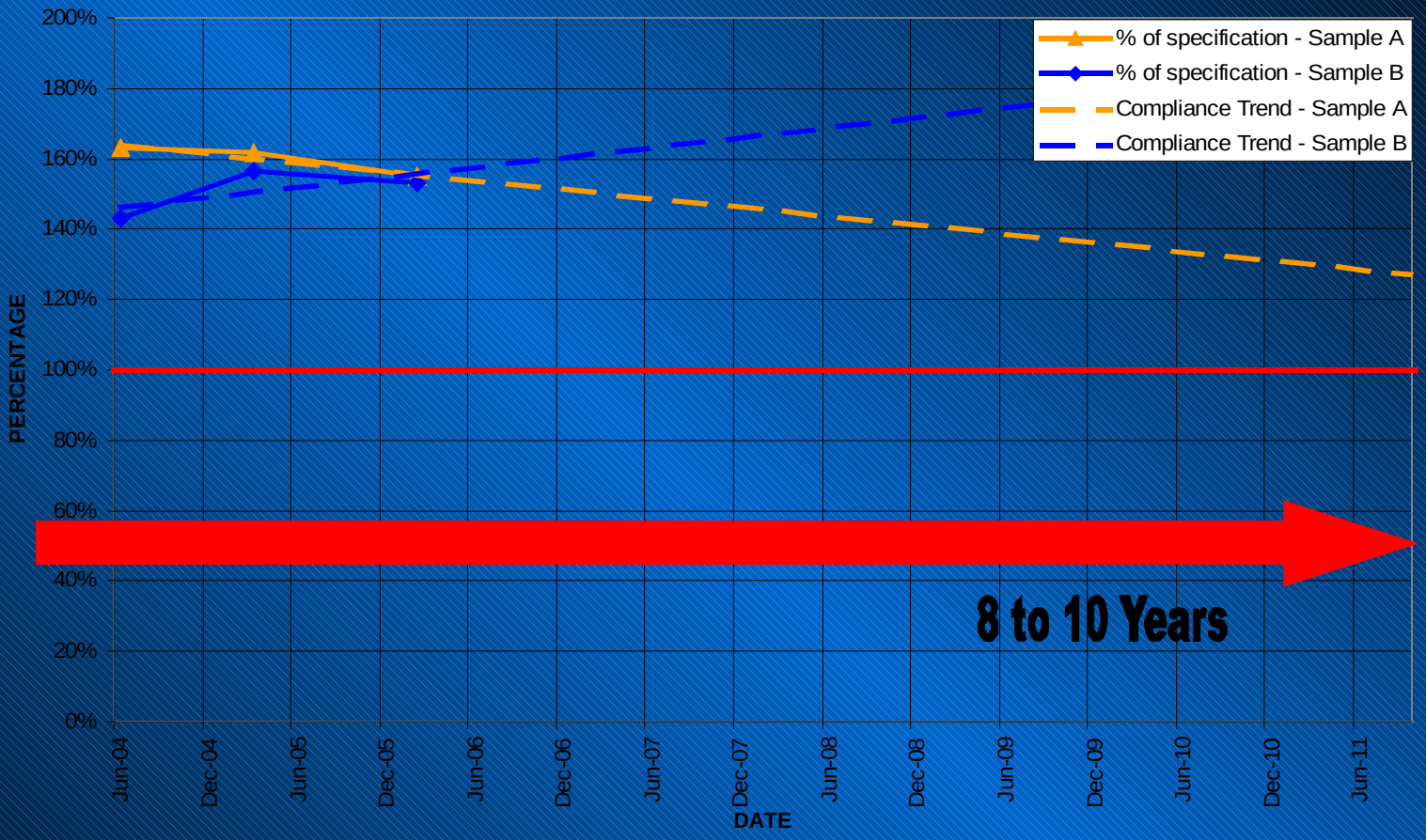

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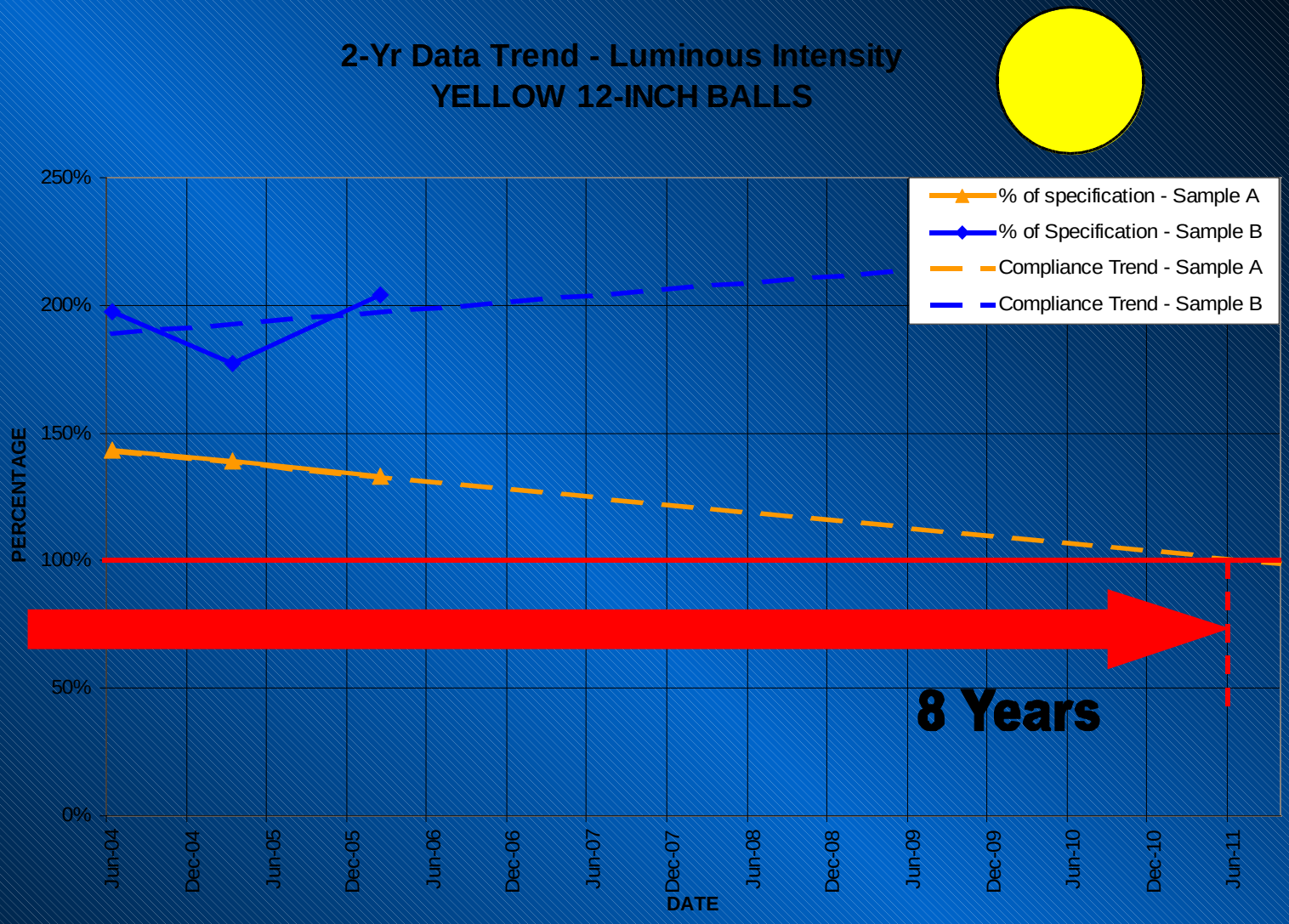

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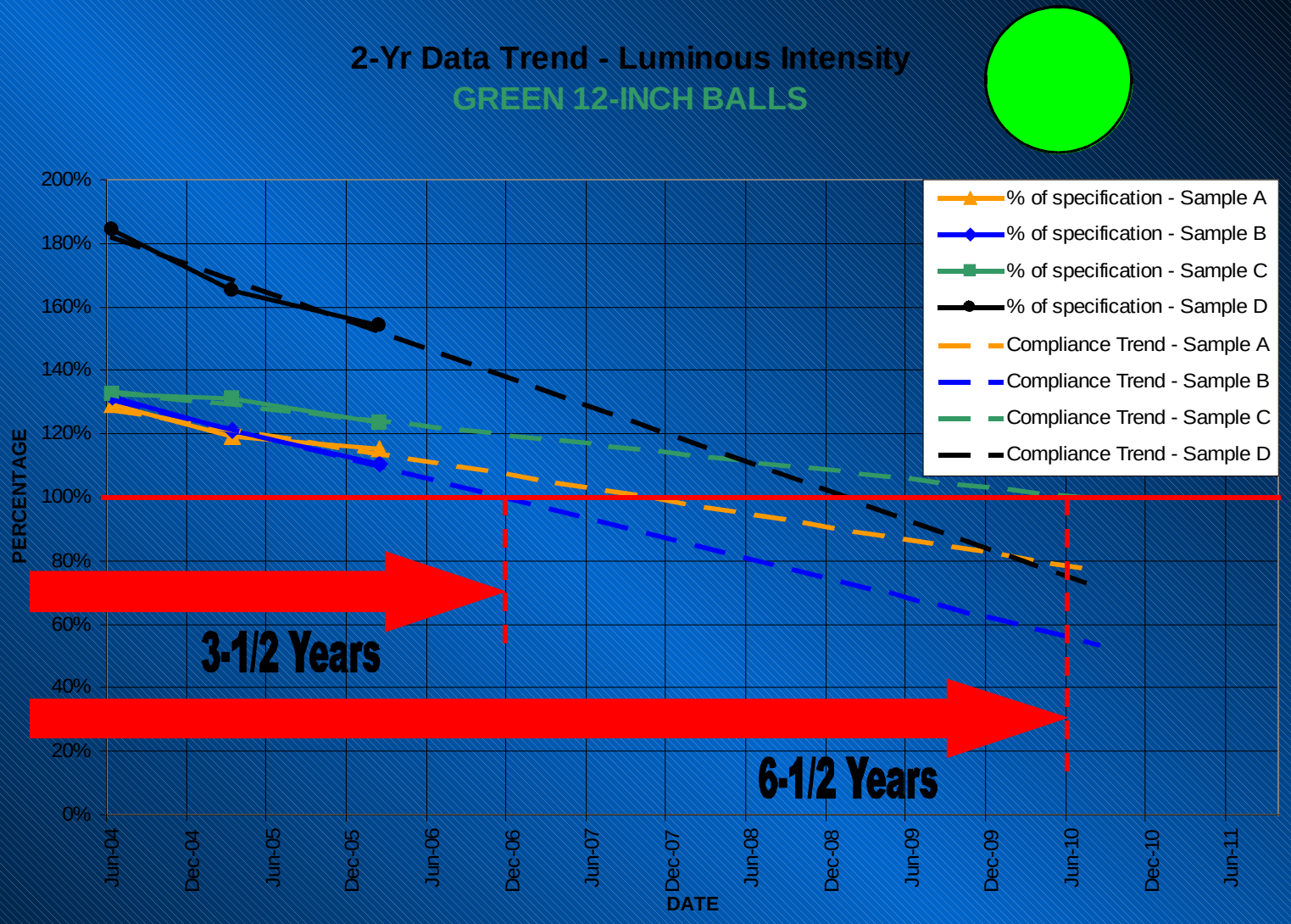

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LED Signal Costs

Type	1992	2001	Present
12 in. Red Ball	$365	$75	$29
12 in. Red Arrow	$216	$68	$27
12 in. Yellow Ball		$130	$36
12 in. Yellow Arrow		$78	$25
12 in. Green Ball		$255	$64
12 in. Green Arrow		$118	$42

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Estimated Payback Period

2001	2006
5.1 years	1.5 years

Future Testing

- Revise test criteria per ITE specifications
- Include additional testing of arrow indications
- Include testing of other manufacturers' products

Things to Consider

- Is there a better way of tracking test samples?
- Should we keep track of LED module installation dates?
- Does quality of the product vary among vendors?
- Should greater emphasis be placed on product quality during evaluations for listing on our QPL and for the award of bids?

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Questions?

FOR MORE INFO...

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